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Forest Insect and Disease Conditions in the Southwest 1976

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Cover photos: Left, witches' brooms on ponderosa pine tree caused by southwestern dwarf mistletoe. Right, Douglas-fir tussock moth larva.

Forest Insect and Disease Conditions in the Southwest 1976

Forest Insect and Disease Management
State and Private Forestry
Southwestern Region, Forest Service, USDA
517 Gold Avenue, SW
Albuquerque, New Mexico 87102

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Insect and Disease Conditions

Conditions in Brief

Bark beetles continued to deplete ponderosa pine, Douglas-fir, and spruce stands in Region 3. A mountain pine beetle infestation on the Kaibab National Forest and the Grand Canyon National Park, Ariz., caused scattered mortality over 75,000 acres of ponderosa pine type. Suppression efforts in 1975 and 1976 helped reduce local populations. Due to the scattered nature of the infestation, suppression logging was not recommended in 1977. The Douglas-fir beetle caused localized Douglas-fir mortality throughout the Region. Tree mortality was heaviest on dry sites where Douglas-fir dwarf mistletoe was abundant or where trees had been weakened by fire. Spruce beetle continued to cause spruce mortality over 75,000 acres in the Jemez Mountains, Santa Fe National Forest, N. Mex. Sanitation and salvage logging removed about 12 MMBF of infested and susceptible Engelmann spruce in 1976. Removal of another 8.5 MMBF is planned for 1977.

Ponderosa pine mortality, due to the roundheaded pine beetle, western pine beetle, and southern pine beetle, decreased throughout the Region in 1976; ips beetle mortality was about the same.

Defoliators were on the increase in 1976. The western spruce budworm caused visible defoliation over about 124,000 acres of fir type, Regionwide. An operational spray project, over about 37,500 acres, to evaluate the long-term effects of pesticides on budworm populations during their buildup phase is planned for 1977. Douglas-fir tussock moth populations continued to increase on National Forest lands in Arizona and New Mexico. These populations are expected to continue increasing in 1977. Chronic tussock moth infestations continued on ornamentals in Santa Fe, Los Alamos, and Ruidoso, N. Mex. Defoliation of aspen stands by the western tent caterpillar in the Southwest generally declined in 1976. Some locally severe infestations still exist in northern Arizona and New Mexico. A 6,000-acre infestation of the New Mexico fir looper collapsed in 1976.

The southwestern pine tip moth continued to damage reproduction-size ponderosa pine in Arizona. However, as these trees increase in height growth, damage caused by this insect decreases.

Other insects causing noticeable tree damage in the Region include the large aspen tortrix, twig-boring beetles, pine sawfly, and needle-mining and tip moths.

Dwarf mistletoes continued to be the most destructive pathogens in Southwestern forests. Growth reduction and tree mortality caused by southwestern dwarf mistletoe on ponderosa pine are estimated to result in a volume loss of 150 million board feet annually. A major effort was made to improve management of dwarf mistletoe-infested stands through use of the simulated yield program SWYLD2. Over 10,000 acres of mistletoe-infested ponderosa pine stands have been surveyed, and control strategies are being developed for these areas. Heavy tree mortality continued to occur in

stands infested by Douglas-fir dwarf mistletoes. Salvage logging and understory sanitation has been recommended to reduce losses.

Black stain root disease, caused by *Verticicladiella wagenerii*, was found infecting pinyons in three locations on or adjacent to the Jicarilla Ranger District, Carson National Forest, in northwestern New Mexico. From 20 to 100 trees per disease center were killed by *Verticicladiella*. This was the first record of black stain root disease in New Mexico. *Armillariella mellea* root rot continued to cause light tree mortality in ponderosa pine plantations of Arizona and New Mexico.

Abiotic diseases, such as hail damage, drought stress, and chloride toxicity from highway deicing salt, resulted in substantial growth loss and/or tree mortality in localized situations in the Southwest.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. This bark beetle (fig. 1) continued to deplete ponderosa pine stands on the Kaibab National Forest and in Grand Canyon National Park in northern Arizona. The outbreak started on the Forest near East Lake in 1971 and increased until 1975 when a suppression program of harvesting infested trees reduced the beetle population. Two and a half million board feet of pine was harvested over 5,000 acres. Even though the outbreak was reduced locally, a buildup occurred on Kane and Tater Ridges, 8 miles southeast of East Lake. Tree losses were sufficiently high, over 6,500 acres, to justify a suppression program. Once again, removal of currently infested trees (3 MM bd. ft.) reduced the local beetle population and subsequent tree losses. Nevertheless, the infestation continued to expand in size outside of suppression areas, and scattered tree losses were detected over 75,000 acres during the 1976 aerial detection survey.

A biological evaluation was made in September 1976, with the following objectives: (1) identify areas where there were concentrations of infested trees, (2) determine infestation buildup ratios in selected stands, (3) obtain estimates of infested trees per acre, (4) qualitatively check beetle broods in infested trees, and (5) predict the 1977 beetle population trend. Strip cruises and stand surveys were made at the southern end of the infestation from Tater Ridge to Dog Lake where the heaviest concentrations of faded trees were found during the 1976 aerial survey. No large groups (25 or more trees) of currently infested trees were found in these areas. Due to the widely scattered infestation elsewhere on the Forest, there should be no concentrations of dead trees. Beetle broods in newly infested trees appeared healthy and the infestation is expected to continue. Tree losses will be scattered over about the same 75,000-acre area that was infested in 1976.

Due to the scattered infestation on the Forest, suppression by logging was determined to be biologically and economically unsound. However, a trap-tree technique may be evaluated over two large areas to determine if low density infestations can be suppressed. A cooperative study with the

Figure 1.—Mountain pine beetle larvae and galleries in ponderosa pine.

Rocky Mountain Forest and Range Experiment Station showed that trap trees were attractive to the mountain pine beetles, and attack densities of trap trees were similar to standing trees.

In Grand Canyon National Park, the infestation is scattered, but tree losses increased from 1975 to 1976. Sawtimber-size, highly susceptible stands occur from Castle Canyon to highway 67 leading to the North Rim of the Grand Canyon. There is a high probability that tree losses will increase in this area.

In northern New Mexico, scattered infestations continued on the Carson and Santa Fe National Forests. The mountain pine beetle in New Mexico appears to prefer old, decadent trees; whereas, relatively healthy trees are killed in northern Arizona. On the Carson National Forest, low-level infestations have been detected for several years on the Penasco, Taos, Tres Piedras, Canjilon, and El Rito Ranger Districts. Yearly fluctuations have occurred, but the infestations have not reached a level where suppression is a viable alternative. Scattered, infested pines were detected on the west portion of the Santa Fe National Forest. Infestations in northern New Mexico are not expected to increase in 1977 to a level where suppression or salvage programs may be considered.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). A 75,000-acre infestation in the Jemez Mountains of the Santa Fe National Forest, N. Mex., continued in 1976, but at a lower level than 1975. During 1976, sanitation and salvage logging removed about 12 MMBF of infested and susceptible Engelmann spruce. Removal of another 8.5 MMBF is planned for 1977.

An infestation in a portion of the White Mountains, Fort Apache Indian Reservation, Ariz., has dropped to near endemic levels. Salvage logging of wind-thrown trees and treatment of green slash to prevent spruce beetle population increases were recommended.

Infested, downed spruce in the Arizona Snow Bowl, Coconino National Forest, Ariz., resulted from windthrow and ski-run construction. A suppression project was conducted to treat infested bolts and stumps by peeling and burning their bark. The project was recommended to deal with a localized infestation which threatened the aesthetics and recreational values of this high-use ski area.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. The level of ponderosa pine mortality from this insect in the Sacramento Mountains of the Lincoln National Forest and adjoining Mescalero Apache Indian Reservation, N. Mex., was considerably less in 1976 than in 1975. Pole-size trees are most commonly attacked by this insect. Since there are few markets in this area for pole-size material, opportunities for salvaging infested trees have been limited.

Western pine beetle, *Dendroctonus brevicomis* LeC. Scattered,ponderosa pines, singly and in small groups, were killed by this bark beetle over portions of all forests in the Southwest. Tree

mortality was noticeably less this year than last on the Pleasant Valley Ranger District, Tonto National Forest; Santa Catalina Ranger District, Coronado National Forest; Prescott National Forest; and Hualapai Mountains, Ariz. Salvage was recommended where concentrations of dying pines were accessible.

Southern pine beetle, *Dendroctonus frontalis* Zimm. Scattered ponderosa and Chihuahua pines in the Santa Catalina Mountains, Coronado National Forest, Ariz., were killed by this insect again in 1976. Continued salvage in accessible stands was recommended.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. This bark beetle was assocated with the Douglas-fir decline observed in many parts of the Southwest during this year and last. Infestations were greatest on the Alpine, Black River, and Springerville Ranger Districts, Apache-Sitgreaves National Forest Ariz.; the Black Range and Glenwood Ranger Districts, Gila National Forest, N. Mex.; and Pecos Ranger District, Santa Fe National Forest, N. Mex. Tree mortality was heaviest in stands on dry sites where Douglas-fir dwarf mistletoe was abundant or where trees had been weakened by fire. Where groups of dying trees were accessible, salvage was recommended to utilize the timber resource.

Ips beetles, *Ips* spp. Ponderosa pine losses in the Southwest from several species of ips beetles were about the same as in 1975. No large epicenters of mortality were observed. Scattered tree losses were detected throughout the ponderosa pine type in Arizona and New Mexico. Most of the tree mortality occurred on marginal growing sites for ponderosa pine where stands were heavily infested with dwarf mistletoe. Salvage logging of ips-killed trees was recommended where it was economically feasible and environmentally sound.

Western spruce budworm, *Choristoneura occidentalis* Free. Regionwide, visible defoliation from this insect on white fir and Douglas-fir increased from 9,843 acres in 1975 to 123,760 acres in 1976. Aerial survey sketch mapping showed 94,840 acres of light defoliation, 26,080 acres of moderate, and 2,840 acres of heavy. Infestations continued to expand and intensify on the Kaibab Plateau, Kaibab National Forest, Ariz., and the Carson, Santa Fe, Cibola, and Gila National Forests in New Mexico. Further increases of these infestations next year were indicated by the 1976 egg mass survey. Suppression was not recommended against any of these infestations.

A cooperative effort, involving the Forest Insect and Disease Management Methods Application Group and Forest Insect and Disease Management in Regions 1 through 4 and 6, was initiated to improve and standardize budworm egg mass sampling methods in order to have more reliable defoliation prediction models by 1978.

An operational spray project to evaluate the long-term effects of pesticides on budworm populations during their buildup phase is planned for 1977. The infestation, covering about 37,500 acres in the Jemez Moun-

tains of the Santa Fe National Forest, N. Mex., may be aerially sprayed with the registered insecticide carbaryl (Sevin®) at 1 pound per acre. Budworm population changes in the treated area will be compared with those in an adjacent untreated area for 3 to 5 years.

Douglas-fir tussock moth, *Orgyia pseudotsugata* McD. Defoliation of Douglas-fir and true firs was found in the Region during 1976. New outbreak centers were found in Canyon del Aqua, Sandia Ranger District, Cibola National Forest; and in Medio Dia Canyon, Tesuque Ranger District, Santa Fe National Forest, N. Mex. These two new infestations cover approximately 100 acres each. The infestation in Trigo Canyon, Mountainair Ranger District, Cibola National Forest, is still at high levels, but is expected to decline in 1977.

Low-level populations in the Sacramento Mountains, Mayhill Ranger District, Lincoln National Forest, N. Mex., and the Sierra Anchas, Pleasant Valley Ranger District, Tonto National Forest, Ariz., detected in 1974, increased in 1976. Additional low-level populations have been detected near Los Alamos; in Cochiti Canyon, Tesuque Ranger District, Santa Fe National Forest; and in the Pinal Mountains, Globe Ranger District, Tonto National Forest. This insect is expected to increase throughout the Region in 1977.

Chronic infestations continued in ornamentals (mainly spruce) in Santa Fe, Los Alamos, and Ruidoso, N. Mex.

Ground tests with *Bacillus thuringiensis* were conducted against the Douglas-fir tussock moth in Santa Fe, N. Mex., in cooperation with the Pacific Northwest Forest and Range Experiment Station. The efficacy of three commercial formulations, Biotrol® XK, Dipel®, and Thuricide® 16B, applied by hydraulic sprayer to ornamental Douglas-fir, white fir, and blue spruce, was evaluated. As in the 1975 tests, Thuricide® 16B gave the best control. Thuricide® 16B is now registered for ground use against the Douglas-fir tussock moth.

Studies to evaluate use of the Douglas-fir tussock moth pheromone to predict population trends were initiated in 1976 and will continue in 1977.

Western tent caterpillar, *Malacosoma californicum* (Pack). Defoliation of aspen stands in the Southwest generally declined from 1975 to 1976, but there were some locally severe infestations in northern Arizona and New Mexico. In the Kaibab National Forest and Grand Canyon National Park, Ariz., most aspen stands, which are mixed together with conifer stock, were heavily defoliated for a second year. Aesthetics were adversely affected along the scenic highway leading to the North Rim of Grand Canyon National Park, but stands quickly refoliated. No tree mortality was observed. On the Santa Fe National Forest in New Mexico, light to moderate defoliation was detected on the Tesuque, Coyote, Espanola, and Jemez Ranger Districts. Again, no mortality was noted.

Tent caterpillar infestations usually persist for 2 to 3 years and quickly decline. Damage to affected stands rarely reaches a point where control is

needed. Outbreaks have started to decline in the Region, and further decreases are expected in 1977.

Southwestern pine tip moth, *Rhyacionia neomexicana* (Dyar). Damage from this insect continued over 26,000 acres of ponderosa pine regeneration on the Chevelon Ranger District, Apache-Sitgreaves National Forest, Ariz., but at a lower level than in previous years.

The results of a cooperative study with Rocky Mountain Forest and Range Experiment Station were published on southwestern pine tip moth deformities and their effects on tree growth. Six deformities were recognized: prune, crook, fork, posthorn, bush, and spiketop. Ninety-three percent of all branch whorls were damaged. Prune and combinations of prune/crook and prune/fork caused the greatest reduction in height growth. Damage to ponderosa pine by this insect can cause up to 40 percent height growth loss. As tree height increases, however, all types of tip moth damage decrease.

New Mexico fir looper, *Galenara consimilis* Hein. An infestation on 6,000 acres of the Lincoln National Forest, N. Mex., collapsed in 1976. Two years of severe defoliation to Douglas-fir and white fir by this insect caused some mortality and top-kill to saplings throughout the infested area.

Other insects. The large aspen tortrix, *Choristoneura conflictana,* (Wlk.), caused some defoliation to aspen stands on parts of the Kaibab Plateau, Kaibab National Forest, Ariz. This insect worked in association with the western tent caterpillar in many stands. Twig-boring beetles, *Pityophthorus* spp., caused noticeable twig mortality to ponderosa pines on portions of the Long Valley and Mormon Lake Ranger Districts, Coconino National Forest, Ariz., and Reserve, Luna, and Quemado Ranger Districts, Gila National Forest, N. Mex., and to pinyons in Chisos Basin, Big Bend National park, Tex. Pine sawflies, *Neodiprion* spp., damaged ponderosa pines in limited areas of the Magdalena Ranger District, Cibola National Forest, N. Mex.; Williams Ranger District, Kaibab National Forest, Ariz.; and Long Valley Ranger District, Coconino National Forest, Ariz. Damage from needle-mining moths, *Coleotechnites* spp., was evident between Luna and Reserve, N. Mex.; on the Gila National Forest; and around Indian Pine, Ariz., on the Fort Apache Indian Reservation. Approximately 1,200 acres of pinyon were damaged by tip moths on the Navajo Indian Reservation, east of Kalgetoh, Ariz. Old needle loss, due to larval mining, ranged from 50 to 90 percent. Loss of new terminals and laterals was estimated to be 25 to 50 percent.

Status of Diseases

Dwarf mistletoes. Dwarf mistletoes continued to be the most damaging diseases in commercial forests of the Southwest. Greatest timber volume losses are caused by the following species of dwarf

mistletoe: *Arceuthobium vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Wiens on ponderosa pine, *A. douglasii* Engelm. on Douglas-fir, *A. microcarpum* (Engelm.) Hawks. and Wiens on Engelmann spruce, and *A. apachecum* Hawks. and Wiens on southwestern white pine. In order to facilitate identification of dwarf and true mistletoes, a guide to mistletoes of New Mexico and Arizona has been prepared. This color-illustrated guide is available from the Forest Insect and Disease Management Staff Unit.

Implementation of the simulated yield program for dwarf mistletoe-infected ponderosa pine (SWYLD2) continued in 1976. About 10,000 acres of infested ponderosa pine stands were surveyed on four National Forests (Apache-Sitgreaves, Gila, Kaibab, and Santa Fe) and the Navajo Indian Reservation. Information gathered in the surveys will assist land managers in developing mistletoe control strategies.

Douglas-fir dwarf mistletoe continues to be the deadliest species in the Southwest. Tree mortality caused by this disease is particularly common in the southern half of New Mexico and Arizona. Mixed conifer stands on the Apache-Sitgreaves National Forest are sustaining heavy growth losses, particularly when Douglas-fir and western spruce dwarf mistletoes both occur in the same area.

Ponderosa pine trees were heavily infected by southwestern dwarf mistletoe in plantations on the Kaibab National Forest and the Mescalero Apache Indian Reservation. If not removed in the near future, these trees will provide an inoculum source for infecting planted seedlings.

Root diseases. Three ponderosa pine plantations on the Santa Fe National Forest were reexamined to determine incidence of *Armillariella mellea* (Fr.) Karst. root rot (fig. 2). During the initial examinations of the three plantations in 1968-72, this disease was causing tree mortality in outplantings. Results of the 1976 surveys indicated *A. mellea* was present in trees on two of the three plantations. The Los Conchas plantation, which had sustained heavy tree mortality from 1968-72, currently had few fading trees. Most dead trees in this plantation died 2 to 5 years ago. A survey in the Roger plantation indicated *A. mellea* was present on 65 percent of the trees which had been dead more than 2 years and 29 percent of trees that had been dead 1 to 2 years. No faders or recent mortality was detected in the survey. *A. mellea* appears to be rapidly declining in this plantation. *A. mellea* was not found in the Fenton plantation.

A. mellea root rot was found in several other plantations throughout the Region, as well as in natural stands; however, the disease was endemic in all situations.

A survey to determine whether *Verticicladiella wagenerii* Kend. is present in northwestern New Mexico and/or northeastern Arizona was made in early 1976. Black stain root disease, caused by *V. wagenerii*, was found in three locations on or adjacent to the Jicarilla Ranger District, Carson National Forest, N. Mex. Root disease pockets were roughly circular in shape and had 20 to 100 dead trees per pocket. The disease was restricted to pinyon trees. Black stain root disease was not found in Arizona.

Figure 2.—White mycelial fans on the root collar are characteristic of an *A. mellea* infection. *A. mellea* root rot killed this tree in a ponderosa pine plantation.

Rusts. Limb rust, caused by *Peridermium filamentosum* Pk., remained at an endemic level in ponderosa pine forests of the Southwest (fig. 3). Branch mortality similar to that caused by limb rust infection occurred in ponderosa pine trees on portions of the Gila and Apache-Sitgreaves National Forests; however, symptoms were determined to be caused by twig borers (*Pityophthorus* spp.).

Spruce broom rust, caused by *Chrysomyxa arctostaphyli* Diet., remained at an endemic level in spruce-fir forests of the Southwest. Fir broom rust, caused by *Melampsorella caryophyllacearum* Schroet, was endemic through most of the Region. However, the fir broom rust infestation on white fir in the Sandia Mountains, east of Albuquerque, N. Mex., continued to increase in epidemic proportions. Infected trees often have 10 to 20 brooms and bole infections. Recreational constraints have prohibited logging to control this disease in the Sandias.

Non-biological diseases. Roadside tree mortality caused by chloride toxicity from deicing salt continued to increase in several areas of New Mexico. Heavy tree mortality occurred along the road to Santa Fe ski area. Tree species affected include ponderosa pine, southwestern white pine, Douglas-fir, white fir, Engelmann spruce, and aspen. Many dead trees along the road to Santa Fe ski area have been removed. Chloride toxicity also resulted in moderate roadside tree mortality near Los Alamos, N. Mex.

About 300 acres of ponderosa pine, pinyon, and juniper trees were severely damaged by a hailstorm on the Navajo Indian Reservation in early 1976. Heavy defoliation, wounding of twigs and branches, and terminal leader mortality were prevalent on affected trees. Injury was most severe on the north half of trees, indicating direction of the storm. Heavily defoliated overstory trees were salvage-logged in mid-1976.

Tree mortality caused by drought stress was reduced from 1975 levels. Scattered ponderosa pine trees throughout the Region died from drought-related causes. Drought stress predisposes trees to secondary insect attacks and/or acts in combination with dwarf mistletoe infection to result in tree mortality.

Frost injury occurred locally on the Coconino National Forest. Gambel oak trees showed typical frost damage symptoms. No tree mortality was noted in association with the frost injury.

Aspen diseases. A cooperative study with Region 2 and Rocky Mountain Forest and Range Experiment Station, evaluating effects of various logging practices on residual aspen trees, continued in 1976. Fieldwork this year consisted of establishing control plots to determine incidence of cankers and stem rots in undisturbed aspen stands. Only 7 to 9 percent of the 180 trees examined had stem cankers. Stem rots were also rather uncommon (0 to 7 percent) on the three control plots. The most prevalent injury was elk "barking" wounds. Elk often feed on aspen bark during winter and spring months. Although many trees sustained these wounds, few were infected by canker-causing organisms.

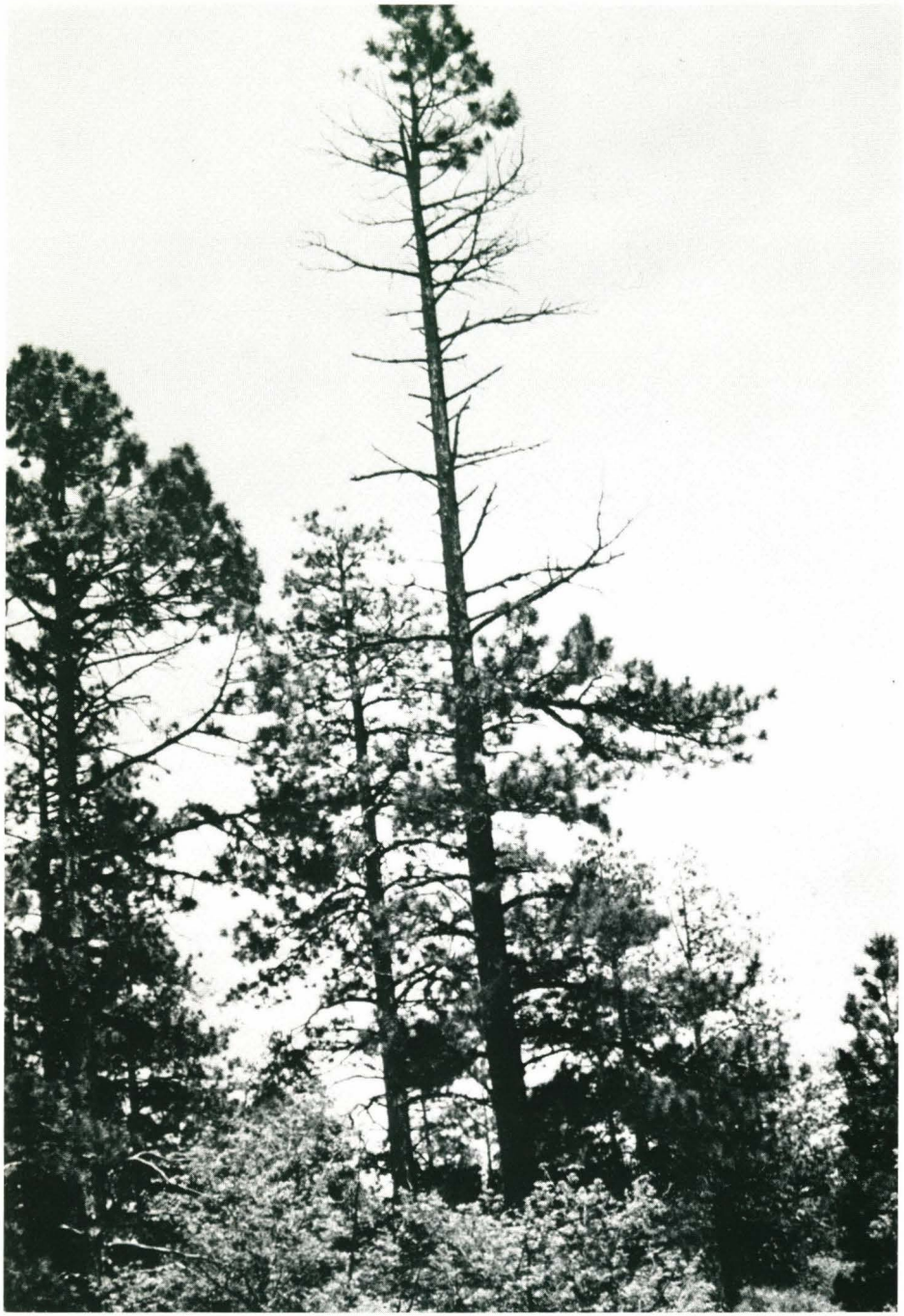


Figure 3.—The window-like appearance of the crown on this ponderosa pine was caused by limb rust. This disease usually begins in midcrown and spreads upward and downward until the tree dies.

Nursery diseases. Planting stock delivered to the Lincoln National Forest and the Mescalero Apache Indian Reservation was injured by several species of mold. Ponderosa pine and southwestern white pine 1-0 and 2-0 stock was injured by molds while in storage before outplanting. Seedling mortality resulted from some mold infections, although most trees were culled before outplanting began. Infection by molds resulted from improper storage and handling of seedlings.

Foliage diseases. Foliage diseases, such as *Elytroderma deformans* (Weir) Dark., *Lirula abietis-concoloris* (Mayr ex Dearn.) Dark., and *Rhabdocline pseudotsugae* Syd., remained endemic throughout the Southwest.

Trunk rots. *Echinodontium tinctorium* (E. & E.) E. & E., on white fir and alpine fir, was frequently found on the Carson, Santa Fe, and Apache-Sitgreaves National Forests (fig. 4). This disease was very common in mature to overmature mixed conifer stands on the aforementioned Forests. Other trunk rots, such as *Polyporus anceps* Pk., *Polyporus volvatus* Pk., and *Fomitopsis pinicola* (Sw. ex Fr.) Karst., remained endemic throughout the Region.

Animal damage. Porcupines continued to cause spiketops by girdling in the upper crown of trees throughout the Region. Frequent injuries were noted on the Carson National Forest.

Small rodents girdled trees on two ponderosa pine plantations in the Santa Fe National Forest. One plantation sustained rather extensive mortality from rodents girdling the base of 3- to 6-foot trees.

Elk caused numerous "barking" wounds on aspen trees, particularly on the Carson National Forest. These wounds do not appear to adversely affect aspen trees, although an intensive study of the situation has not been completed.

Air pollution. Ponderosa pine trees continued to die along a railroad track between Flagstaff and Williams, Ariz. Tree mortality was first noted in 1975 and has increased during 1976. Affected trees have chlorotic or brown needles and characteristically cast many needles prematurely. Trees nearest to the tracks were more frequently affected than those farther from the tracks. The precise causal agent has not been determined; however, diesel emissions from passing trains may be related to tree injury. Herbicide injury has been eliminated as a potential cause for the tree mortality.

State of Arizona Insect and Disease Conditions—State and Private Lands

Western pine beetle, *Dendroctonus brevicomis*. Widely scattered mature ponderosa pines were killed by this beetle on private land near

Figure 4.—*Echinodontium tinctorium* conk on a white fir tree. This trunk rot fungus often enters the tree at dead branch stubs.

Prescott, Showlow, Pinetop, Lakeside, Flagstaff, and the Hualapai Mountains near Kingman, Arizona. Removal of infested trees was recommended where practical.

Ips beetles, *Ips* spp. Tree losses on private land, due to ips beetles, increased in 1976. The most important ips beetle was *Ips lecontei*. The majority of the tree mortality occurred west and southwest of Prescott. Mechanical damage—soil compaction, severed roots, and stem wounds—around new home construction sites weakened trees, making them more susceptible to bark beetle attack. Felling, bucking, and covering infested material with clear polyethylene sheeting was recommended. Covering infested bolts prevents adult emergence and causes larval mortality due to a buildup of temperature under the plastic.

Pinyon needle scale, *Matsucoccus acalyptus*. Pinyon needle scale damage decreased in 1976 in Prescott, Arizona. Female scale emergence occurred earlier than normal in 1976. A post-emergence snowfall apparently killed many of the newly emerging insects, causing the decline. Cultural and chemical control was recommended. Cultural control involves washing the eggs from the trunk of the tree, bagging eggs and litter from under the tree, and disposing of it.

Southwestern pine tip moth, *Rhyacionia neomexicana*. This insect damaged leader and lateral branches of ponderosa pine reproduction, mainly in Showlow, Pinetop, Lakeside, and Flagstaff. Pruning and burning infested branches was recommended.

Tent caterpillar, Malacosoma spp. Scattered ornamental trees were defoliated throughout Arizona by these insects. Quaking aspen and willows (*Salix* spp.) were the principal hosts. Removal and disposal of branches containing tents was recommended.

Southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *cryptodpodum* (Engelm.) Hawks. and Wiens. Southwestern dwarf mistletoe was the principal pathogen causing tree mortality on private lands in Arizona. Silvicultural treatment to reduce the impact of dwarf mistletoe was recommended. Silvicultural control involves the removal of heavily infected trees and pruning of infected branches where tree removal is not practical.

Range Caterpillar

Approximately 737,000 acres of Federal, State, and private lands were treated with Dylox® 1.5 oil against range caterpillar by the Animal and Plant Health Inspection Service (APHIS). Forest Insect and Disease Management assisted APHIS on nearly 60,000 acres of the Kiowa National Grasslands. Good control of this insect was achieved. Forty-nine of the 50 sample

plots on the National Grasslands had a population reduction below the economic threshold (2.5 larvae/m^2).

Recent Publications (1976)

Copies of these publications can be obtained from Forest Insect and Disease Management:

Acciavatti, R.E., and D.T. Jennings. 1976. Locating western spruce budworm egg masses with ultraviolet light. USDA Forest Serv. Res. Note RM-313. 3pp.

Lessard, G., and P.E. Buffam. 1976. Effects of *Rhyacionia neomexicana* on height and radial growth in ponderosa pine reproduction. J. Econ. Entomol. 69: 755-756.

Lessard, G., and D.T. Jennings. 1976. Southwestern pine tip moth damage to ponderosa pine reproduction. USDA Forest Serv. Res. Pap. RM-168. 8 pp.

Walters, J.W. 1976. A guide to mistletoes of Arizona and New Mexico. USDA Forest Serv., Southwestern Region. 21 pp.

Aerial Detection Survey

Aerial detection surveys were conducted from July through September on 12 million acres of forested lands in Arizona and New Mexico. The acreages flown by ownership are tabulated below:

State	Ownership	Acres (millions)
Arizona	National Forest	5.1
	National Park Service	0.1
	Indian Lands	0.3
	Other Federal*, State and Private	0.1
New Mexico	National Forest	5.7
	Indian Lands	0.6
	Other Federal*, State and Private	0.1

*Other Federal ownership includes Bureau of Land Management, National Monuments, Energy Research and Development Administration, and U.S. military installations.

Progress With Aerial Photography

Region 3 Forest Insect and Disease Management personnel tested a new aerial camera mount designed for the 70 mm Hasselblad 500 EL/M

camera. The camera mount requires a 4-inch hole in the aircraft floor and is secured with Barry shock mounts. The mount secures the camera, eliminating most aircraft vibration, and allows for correction of aircraft drift.

The 70 mm Hasselblad 500 EL/M camera was chosen for its unique capabilities: (1) a motorized film advance with an intervalometer; (2) a large film format allowing direct interpretation from transparencies; (3) compatibility of 70 mm with modern stereoscopes; (4) availability of film in 100-foot rolls; and (5) ability to purchase and store enough film from one emulsion batch to meet annual needs.

An operational aerial photographic mission, evaluating spruce mortality on the Fort Apache Indian Reservation, Arizona, was done in 1976 using this system. Results of this evaluation show that accurate estimates of dead spruce can be obtained using 70 mm aerial infrared photography. A report is being prepared and will be issued soon.

A New Computer Program for Tree Damage Surveys

Region 3 Computer Systems Staff Unit personnel have recently revised the data summary computer program, NSEC. The new, improved program, termed PEST, will simultaneously compile information on up to eight distinct tree damage classes, print stand summaries in trees and basal area per acre, and compute statistical analyses for each class total. Field cruises can be made using fixed plots, variable plots, or strips. Field data, consisting of numbers and diameters of trees for each damage class found per plot, can be tallied directly on key punch forms. PEST is a simple, yet flexible, program for summarizing forest insect and/or disease tree damage information.

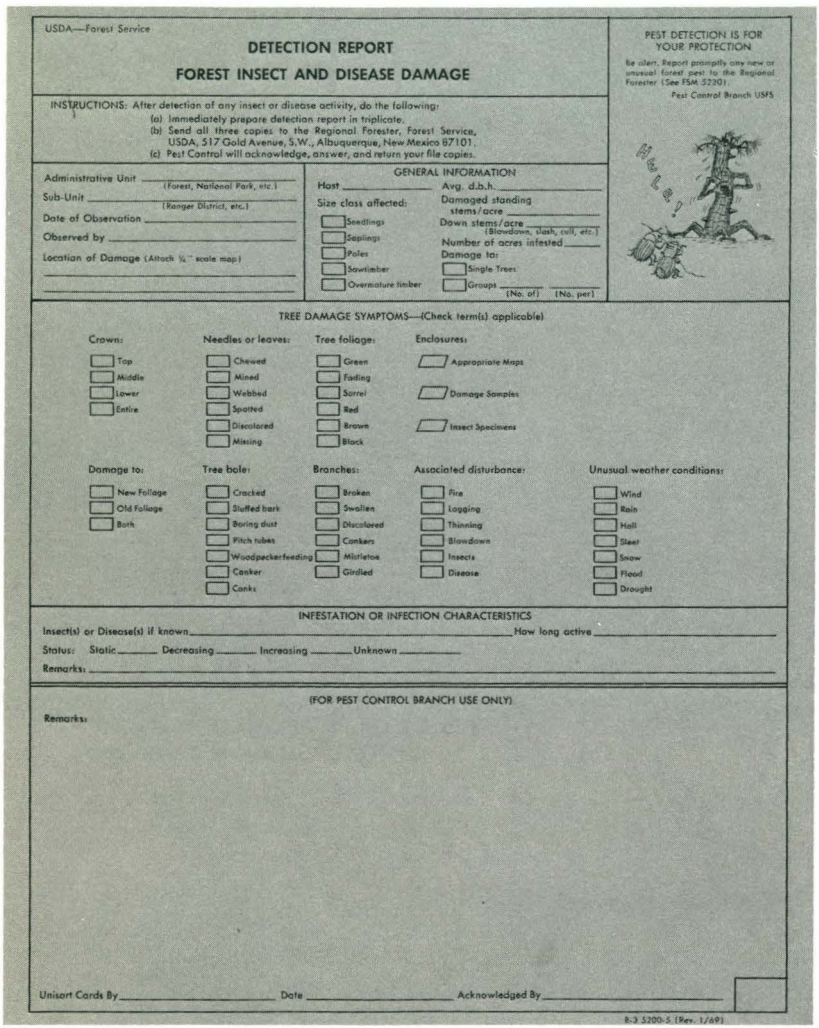
Forest Insect and Disease Detection

The detection of forest insects and diseases is a two-part program. The first phase consists of field surveillance carried on by the land manager during assigned duties. The second phase consists of aerial and ground detection surveys conducted by FIDM personnel. The importance of the first phase of the detection program cannot be overemphasized. Excellent opportunities for early detection of insect and disease outbreaks can be provided by land managers to assure a timely and accurate evaluation of the problem, which is vital if suppression is needed. Promptly report any unusual insect or disease problem to FIDM on form R-3 5200-5 (fig. 5).

In 1976, 52 detection report forms (R-3 5200-5) were received by FIDM. In general, the information provided on the form was adequate for prompt and accurate determinations to be made. A common error was not providing all possible information in the "General Information" and "Tree

Damage Symptoms" sections—particularly the host tree species. Also, the "Remarks" section at the bottom of the form should be reserved for FIDM response. Additional comments about a particular problem were helpful to FIDM in making determinations. These comments should be included whenever possible, but they should be placed on a separate sheet of paper and attached to the back of form R-3 5200-5.

REMEMBER—PEST DETECTION IS FOR YOUR PROTECTION. Be alert! Please report promptly any new or unusual forest insect or disease outbreaks to the Forest Service, Forest Insect and Disease Management Staff Unit. Information concerning forest pest problems can most easily be reported on the Detection Report form (R-3 5200-5). A sample of this Detection Report form is shown below. If you need additional information or forms, please write or give us a call at (505) 766-2440.


USDA—Forest Service

DETECTION REPORT

FOREST INSECT AND DISEASE DAMAGE

PEST DETECTION IS FOR YOUR PROTECTION

Be alert. Report promptly any new or unusual forest pest to the Regional Forester (See FSM 5220)

Pest Control Branch USFS

INSTRUCTIONS: After detection of any insect or disease activity, do the following:
(a) Immediately prepare detection report in triplicate.
(b) Send all three copies to the Regional Forester, Forest Service, USDA, 517 Gold Avenue, S.W., Albuquerque, New Mexico 87101.
(c) Pest Control will acknowledge, answer, and return your file copies.

Administrative Unit _____ (Forest, National Park, etc.)
Sub-Unit _____ (Ranger District, etc.)
Date of Observation _____
Observed by _____
Location of Damage (Attach ¼" scale map)

GENERAL INFORMATION

Host _____ Avg. d.b.h. _____
Size class affected: ☐ Seedlings ☐ Saplings ☐ Poles ☐ Sawtimber ☐ Overmature timber
Damaged standing stems/acre _____
Down stems/acre _____ (Blowdown, slash, cull, etc.)
Number of acres infested _____
Damage to: ☐ Single Trees ☐ Groups _____ (No. of) _____ (No. per)

TREE DAMAGE SYMPTOMS—(Check term(s) applicable)

Crown: ☐ Top ☐ Middle ☐ Lower ☐ Entire

Needles or leaves: ☐ Chewed ☐ Mined ☐ Webbed ☐ Spotted ☐ Discolored ☐ Missing

Tree foliage: ☐ Green ☐ Fading ☐ Sorrel ☐ Red ☐ Brown ☐ Black

Enclosures: ☐ Appropriate Maps ☐ Damage Samples ☐ Insect Specimens

Damage to: ☐ New Foliage ☐ Old Foliage ☐ Both

Tree bole: ☐ Cracked ☐ Stuffed bark ☐ Boring dust ☐ Pitch tubes ☐ Woodpeckerfeeding ☐ Canker ☐ Conks

Branches: ☐ Broken ☐ Swollen ☐ Discolored ☐ Cankers ☐ Mistletoe ☐ Girdled

Associated disturbance: ☐ Fire ☐ Logging ☐ Thinning ☐ Blowdown ☐ Insects ☐ Disease

Unusual weather conditions: ☐ Wind ☐ Rain ☐ Hail ☐ Sleet ☐ Snow ☐ Flood ☐ Drought

INFESTATION OR INFECTION CHARACTERISTICS

Insect(s) or Disease(s) if known _____ How long active _____

Status: Static _____ Decreasing _____ Increasing _____ Unknown _____

Remarks: _____

(FOR PEST CONTROL BRANCH USE ONLY)

Remarks:

Unisort Cards By _____ Date _____ Acknowledged By _____

R-3 5200-5 (Rev. 1/69)

Figure 5.—Detection Report form (R-3 5200-5)

Posters

FIDM has posters (fig. 6) available for land managers who want to use them for display. The posters have color photographs and technical information. The posters available now are:

1. Spruce budworm
2. Mountain pine beetle
3. Spruce beetle
4. Ips
5. Tussock moth
6. Roundheaded pine beetle
7. Range caterpillar
8. Dwarf mistletoe

The posters are issued on a lend basis and may be obtained by contacting the Forest Insect and Disease Management Staff Unit.

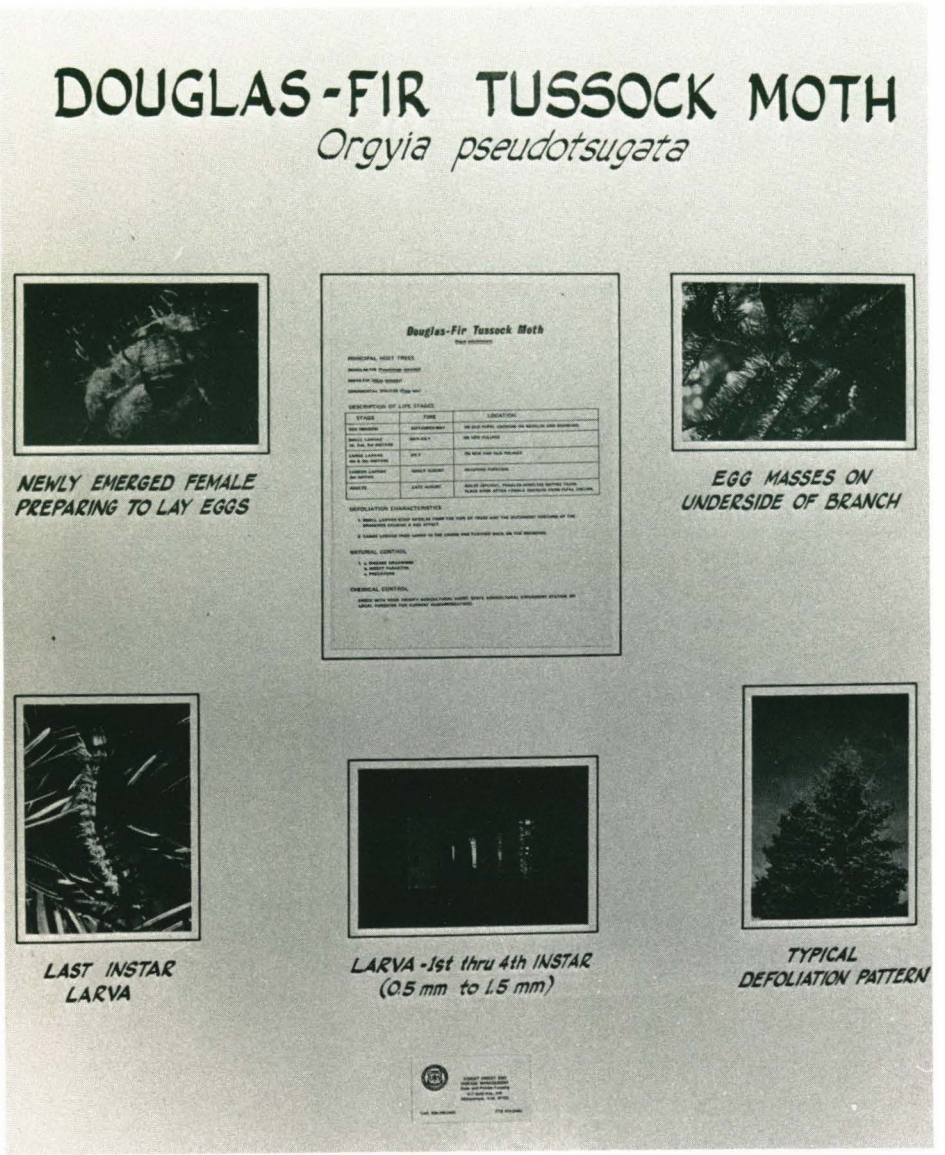

DOUGLAS-FIR TUSSOCK MOTH
Orgyia pseudotsugata
NEWLY EMERGED FEMALE PREPARING TO LAY EGGS
Douglas-Fir Tussock Moth
EGG MASSES ON UNDERSIDE OF BRANCH
LAST INSTAR LARVA
LARVA -1st thru 4th INSTAR (0.5 mm to 1.5 mm)
TYPICAL DEFOLIATION PATTERN

Figure 6.—Douglas-fir tussock moth poster.

☆ U.S. Government: 1977—777-833 Region No. 8

NATIONAL FORESTS IN ARIZONA AND NEW MEXICO